Understanding Synchronous Computer-Mediated Classroom Discussion through Cultural-Historical Activity Theory

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ABSTRACT
This study is about graduate students' discourse practices in classroom text-based synchronous computer-mediated discussions (SCMD). Cultural historical activity theory (in short, Activity Theory) is the primary theoretical lens through which the data are analyzed. Engeström's (1987) Activity System model among the various theoretical positions or perspectives of activity theorists has guided the overall process of the study, especially having the researcher focus on the identification and description of the model's six key elements: subject, object, tool, community, rule, and division of labor. Several emerging themes were identified: instead of a single utterance, a topical pair needs to be investigated as a unit of analysis in SCMD research; a collective unit of actions emerges through the discourse activity; and, finally, an ecological view is needed to understand an activity system as a whole. Based on these emerging themes, the implications for future research are discussed as a conclusion.

INTRODUCTION
This study is about graduate students' discourse practices in classroom text-based synchronous computer-mediated discussion (SCMD). Since the introduction of synchronous computer-mediated communication (SCMC) to educational practices, its technological affordances of both real-time and remote interactions have been supposed to enrich and promote students' social interactions, and, consequently, their learning (Beauvois & Jamieson, 1997; Dickey, 2003; Duemer et al., 2002; Kern, 1995; Lobel, Swedburg, & Neubauer, 2002; Warschauer, 1996; Sotillo, 2000). This assumption has made more and more educators adopt the technology in their practices to facilitate peer discussions and interactions.

Although the synchronous communications through wired or wireless network of computers are prevalent in current days, the pedagogical application of the technology has not been fully explored, and, furthermore, theoretical explication of it does not have sound foundation that most researchers agree upon yet (De Laat, & Lally, 2003; Luppicini, 2007). Researchers have emphasized the needs of more comprehensive theoretical framework, such as Cultural-Historical Activity Theory (Activity Theory), that provides both socio-cultural and systemic accounts for the educational use of the technology (Resta & Laferrière, 2007; Tolmie & Boyle, 2000). This study is an explorative attempt to use Activity Theory as a theoretical and methodological framework for the analysis of students' discourse practices in SCMD. Therefore, the purpose of this study was to explore and describe students' discourse activity with SCMC technology through the lens of Activity Theory, and to deepen and broaden our understandings on Activity Theory in CMC research through the lens of SCMD.

A BRIEF INTRODUCTION TO ACTIVITY THEORY
Vygotsky's socio-cultural theory of learning is a root of Activity Theory. He introduced the concept of tool-mediation in human activity to illustrate the uniqueness of human intellect (Vygotsky, 1978). According to him, we cannot successfully identify higher mental function of human psychology with any theoretical assumption of direct encounters between a subjective agent and objective world. It will lead us only to either material determinism in which the agent is considered a sum of reflected objective world, which does not take the dynamic roles of human beings in practices into account, or cultural reductionism in which the symbolized culture in the human mind determines the interpretation of the world, which is not capable of explaining the critical role of the objective world in human intellects.

To explicate the unique aspects of the human mind, Vygotsky (1978) devised the concept of tool-mediation in human activity, in which a subject and the external world are mediated by material and psychological means produced in the past of the subjects' individual or the societal history. Of course, this is not the first attempt to introduce a mediator to explain human mind. For example, Piaget, influenced by Emmanuel Kant's categories of mind, suggests schema as such a mediator (Duncan, 1995). An individual cannot come across the external world directly. The encounter is only possible through schema that belongs to the individual who is actively trying to interpret the world to survive in it. To achieve equilibrium between the inner schema and the outer condition, the cognizant is continuously assimilating the external world and accommodating the internal schema, which leads the genetic process of cognitive development. In his framework, the cognitive schema mediates an individual's biological needs of seeking equilibrium and the external environments' affordances affecting and limiting the

realization of the agent's needs. In addition to that, he argues that, being consistent with Kantian metaphysical epistemology, the cognitive development follows universal structure, which is presumed to individual experiences a priori.

Similar to Piagetian theory, Vygotsky's cultural tool needs also be seen as a lens through which a person can have relations with the external world and that forms or conditions the relationship, not a simple device to facilitate human activity. In the system of tool-mediated activity, the subject representing the human mind can only run into material environment through the help of cultural artifacts or instruments, which is the role of cognitive schema in Piagetian theory.

What distinguishes Vygotsky's psychological tool from Piaget's cognitive schema as a mediating means is the social origin of the mediator (Wertsch, 1998). Contrary to Piagetian accounts based on biological heredities and metaphysical structure, Vygotsky places the social origins of the auxiliary tools and the developmental stages at the center of his theory. Vygotsky's mediator is also a social product of one's own or others in the society, while the cognitive schema of Piaget is based on the universal structure given 'a priori' to any individual's experiences.

Extending and elaborating Vygotsky's idea, Leont'ev (1978), his student and colleague, proposed an activity theory called Cultural Historical Activity Theory later. He asserts that the object of psychological study should be neither objective behavior nor subjective consciousness of the human mind, but the whole object-oriented activity. In practice, a subject, participating in object-oriented activity, confines herself to the condition of the object to realize her intention, and the object is subjugated under the motive of the subject. He calls the former as "objectification of the subject" and the latter as "subjectification of the object" (Leont'ev, 1978). Subject and object do not exist indifferently any more, but interdependently in human activity, which is the way that Activity Theory resolves the traditional contradiction of subject versus object.

Leont'ev (1981) distinguishes three levels of activity – activity, action, and operation – by analyzing the division of labors in collective practices, which are connected to collective motive, individual goal, and the condition of material and semiotic tools in order. The action of a pitcher throwing a ball to a catcher in a baseball game cannot be understood without the consideration of the collective motive of the team, winning a game, and the operations of the material and semiotic tools such as balls, gloves, game rules, and so forth. While Vygotsky's model is based on dyadic interaction between a child and an adult or a more advanced other, Leont'ev's framework extends it to individual actions in a collective activity, which can be properly construed only through systemic lenses.

Engeström (1987) articulates and visually depicts Vygotsky and Leont'ev's arguments. He situates Vygotsky's tool-mediated and object-oriented action into Leont'ev's collective activity, and formulates an activity system model, in which social factors such as rule, community, and division of labor are incorporated to illustrate the interconnectedness of each component of the system. In the system, community is defined as a group of people who share the same general object; rule refers to the explicit and implicit regulations, norms, and conventions that constrain actions and interactions within the system; and division of labors indicates that the division of tasks between members of the community both horizontally and vertically.

METHODS
Site
The site of this study was a graduate course offered in the Department of Educational Psychology at a large research university in the southern United States in the fall semester of 2009. The course, open to both master's-level and doctoral students, had been offered every other year for more than 20 years. The instructor had been employed the classroom online discussion using either synchronous or asynchronous CMC technology since 1994. It was basically a seminar-type course for advanced graduate students, in which peer discussions in both face-to-face and CMC modes were the primary classroom activities rather than teacher-led lectures.

Students were required to meet weekly to discuss three or four articles on theories of writing and composition in general. Each week, the class met first in a classroom in which the instructor and students sit at tables arranged in a large circle encompassing all the class members. After a short announcement and lecture-type summary of the readings, the instructor typically began the oral discussion by inviting the students to share their ideas on the readings with other classmates and to raise any issues related to the topics. The oral discussion usually lasted for an hour and 30 ~ 45 minutes.

After a 10 to 15 minute break, students walked to a computer lab, and continued the online discussion using a Web-based chat system. The computer lab was configured to be more relevant to lecture type activity or

individually separated works than small group collaborations, which turned out to be helpful for students to focus on the discussion displayed on each monitor. Other sounds, however, such as typing keyboards, clicking mouse buttons, and laughing, were somewhat distracting for students' concentration.

During each session of online discussion, students saw a window on their screens, embedded in a Web page, with two panes separated by a horizontal line. In the top pane, they read the messages as they were posted. Whenever a participant sent a comment, it was posted to the discussion in the order received by the server. Comments were displayed in the top pane chronologically, one after the other, with the ordinal numbers and the authors' names. All comments previously posted in the discussion were available for the participants to read at any time. If a participant intended to read a comment posted earlier in the discussion, he or she might simply scroll up the list in the top pane to locate it.

In the bottom pane, students composed their own messages by typing and editing just as they would do with word processing software. Unlike other current synchronous instant messaging programs, the software did not provide any functionality of noticing if others were composing their message currently. The users could not have any indication of whether others were composing a message until the comments were posted. A participant had to hit the "enter" or "return" key to send a message, and it appeared in the top pane as a part of the public discussion.

Participants
Of the nine students enrolled in the course on the 'theory and practice of writing seminar,' six were women and two were men. The students came from various programs in the college of education at the doctoral level: three students from Educational Psychology; three students from Language and Literacy; two students from Foreign Language Education (FLE); and one student from Special Education. This group of students was also diverse in terms of ethnicity. There were two Asian, two Mexican-American, and five white Americans.

Data sources
The primary source of data was the transcript of SCMD. There were 13 online synchronous discussion sessions out of 14 classes. The first session was a kind of exercise for students to experience the SCMD, which lasted about 10 minutes, and there were no online session at the last class meeting when students and the teacher met at a place outside the campus. Except for the first exercise session, the members as a group produced 82 (the seventh session) to 158 (the second session) messages for about 30 to 45 minutes. The transcripts were saved on the server as a downloadable text file. As secondary data sources, weekly readings, field notes from the observation of classroom oral discussions, recorded audio-files of them, and other documents that students wrote as class assignments were collected and analyzed as needed.

Note on trustworthiness
Lincoln and Guba (1985) have suggested various techniques to establish trustworthiness of qualitative research. This study employed some of their techniques: prolonged engagement, persistent observation, triangulation, peer debriefing, and keeping a reflexive journal.

To minimize possible distortions that might result from my presence in the classroom discussion, even as a silent observer, I sustained the engagement with the participants from the beginning to the end of the semester (*prolonged engagement*); participated in and took field notes of every classroom discussion to avoid any biased interpretation based on partially collected data (*persistent observation*).

Triangulation is the use of multiple sources of data, multiple settings, and multiple methods of data collection to support emerging research themes and to explain the research findings (Lincoln & Guba, 1985). As described earlier, this study had a variety of data sources including audio files of classroom oral discussions, field notes from classroom observations, assigned readings, and other documents produced by students as well as the transcripts of SCMD sessions, which were collected utilizing multiple methods. The evidence from these different sources and different methods was continuously explored, connected, compared, and synthesized to construe the complicated structure and dynamics of SCMD.

The findings from on-going analyses and the interpretations of them were discussed with other colleagues who were not directly participating in the study (*peer debriefing*), and I recorded thoughts, decisions, questions and insights related to the research (*keeping a reflexive journal*). From my personal experiences with content analyses in SCMD, I expected that there would be many instances that have no clear evidence of what the comment means, which message it is responding to, what the primary purpose of the speech act is, and so forth. I used short and informal interviews with participants, as needed, to lessen the ambiguity of the data (*member*

checking).

AN OUTLINE OF THE ACTIVITY SYSTEMS IN SCMD

There were 14 class meetings in the semester, of which 13 classes had online discussion sessions. The first online session lasted about ten minutes, because it was a kind of introduction to the new environment and communicational mode. Thus, actually, 12 sessions were devoted to discussion on class topics. The participants produced total 1,682 utterances during 13 SCMD sessions, which was 129.4 per each.

Subjects: Subject of an activity system is defined as "the individual or subgroup whose agency is chosen as the point of view in the analysis" (Engeström, n.d., para. 4). Because the purpose of this study was to trace the discourse activity in SCMD in a graduate course, the instructor and the nine students who participated in the online chat sessions were the subjects of the activity system in question.

Objects: In any conversational situation, the interlocutors make efforts to fit their utterances into the topic or to change it with their speech acts. Therefore, a discourse topic is posited as the object of individual activity in this report, which will be transformed into an utterance, as the outcome, of its author as the subject. A topic can either be imposed from the outside of the current system or emerge from the inside. Usually, the syllabus of a course has its list of class topics that will be the starting or major topic of each class. On the other hand, there are discourse topics unfolding in the middle of the discourse practices. For the most part, these emerging topics are nested under the given class topics.

Tools: An utterance should be in the forms of "electronic" and "written text" in SCMD. The interlocutors utilize written texts to express their idea or to interpret others' thought, and operate SCMC technology to deliver their own message and to receive others'. As Activity Theorists contend, there are two categories of material and semiotic tools in any activity. The SCMC technology such as computer hardware and software may be regarded as the example of material tools, while the written text is a semiotic means.

Community: Because this project regarded the topic as the object of the system, community was made up of the class members who shared the general class topics. However, although some class topics were given to all the members, discourse topics also dynamically emerged and disappeared with the interlocutors' continuous gathering and dispersing. The people who shared a discourse topic also formed a community that would be called as a sub-community of the whole class community.

Rules: This study could identify three categories of rules in the activity system. Those were related to the tool use, institutional context, and rhetorical situation of topical discussion. First, the functionalities and affordances of technology controlled students' activity. It was critical to follow the rules to operate the tools, for the SCMC connected the interlocutors' communication physically. Second, the University's institutional rules and the instructor's pedagogical practice governed the system. Finally, the analysis found some patterned rhetorical practices in SCMD. Of course, there was no explicit rule or norm of how to develop topical discussions, the subjects showed repeated patterns of participation such as opening, topical discussion, and closing.

Divisions of labor: Four types of key roles emerged from the SCMD. They were instructor, technological leader, socio-emotional facilitator, topical initiator and follower, and experts in different domains of knowledge.
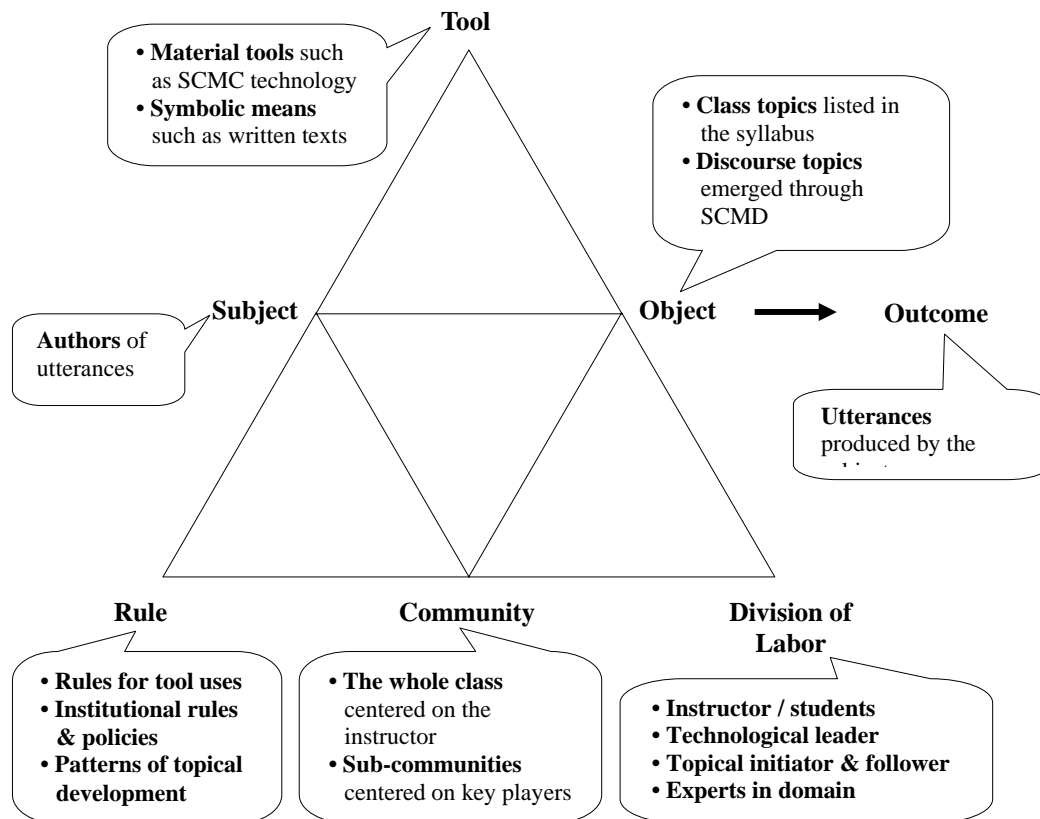
Figure 1. Summary of Activity Systems in SCMD

SCMD THROUGH ACTIVITY THEORY

Based on the activity system described above, three themes emerged. Firstly, the pair of dialogical utterances may be investigated as the minimum unit of analysis in SCMD research. Secondly, even though temporary and fragile, there is the moment that a collective unit of subjects emerges. Finally, both within and beyond the current system, the discourse activity with SCMC technology may be explained as an ecology of activity systems.

Topical pair as the minimum unit of analysis in SCMD research

10. Joyce: Has anyone experienced flow when writing? What about during other activities?
21. Henry: @Joyce (#10)-I think sports is the immediate context for me, although watching sports and losing track of time probably doesn't count as flow. (From Session 9, October 22, 2009)

An utterance is a response to a preceding speech act in a dialogical context. It is, in terms of Speech Act Theory, the perlocutionary effect as a rejoinder of the illocutionary intention of the responded utterance. Henry's comment (#21) answered Joyce's illocutionary forces of questioning. The part of "the immediate context" in Henry's exchange cannot be comprehended unless the content of Joyce's question is taken into account. Considering the class topic of the session, "Influence of Emotions on the Writing Process," and the fact that one of the weekly readings was related to the experience of psychological flow, we may conjecture what Joyce would have had in her mind when raising the issue of flow as a response to a preceding utterance of the class topic or the course reading. To understand the current utterance, it is necessary to apprehend the utterance to which it responds. Without the consideration of the preceding utterance as a part of the whole, it is not possible to understand the meaning and the intention of the current speech act in a given situation.

On the other hand, a subject initiates an utterance to have a rejoinder in the future. In the example, Joyce posted the comment to invite others to the topical space about the experience of flow in writing or other activities. The illocutionary intention of her inquiry may only be achieved with the help of others. With Henry's cooperation as a perlocutionary effect, her speech act could be completed. A question is to elicit answers, and an argument is to prompt acknowledgement, agreement, or counter-argument. To conceive of an utterance as a unit of analysis, as Bakhtin argues, the dialogical chain, as a whole, needs to be taken into account, not a speech act isolated from it. This point raises an issue of the unit of analysis in a dialogical situation such as SCMD.

For Vygotsky (1986), the unit of analysis is "a product of analysis," which "retains all the basic properties of the whole," and "cannot be further divided without losing them" (p. 5). It is not "the chemical composition of water," but "its molecules and their behavior" as the unit of analysis to understand the properties of water. Continuing the argument, he insists that the unit of human intellect be the "word meaning."

> What is the unit of verbal thought that meets these requirements? We believe that it can be found in the internal aspect of the word, in word meaning. Few investigations of this internal aspect of speech have been undertaken so far, and psychology can tell us little about word meaning that would not apply in equal measure to all other images and acts of thought (Vygotsky, 1986, p. 5).

Language is not a device that an individual has created through his or her ontogenetic history. It is the property of a society, and the person can only appropriate it. The "internal aspect of the word" is the "word meaning," which indicates, in terms of Vygotsky, the auxiliary means that has been internalized through the social interactions in the individual's life. His approach is investigating human psychology as the internalized means that has once belonged to the objective world. Therefore, the argument underlying the "word meaning" as the unit of analysis is that both the internal consciousness and the external object should be conceived as a whole that cannot be reduced to isolated elements. Leont'ev (2009) points out:

> Thus activity that is internal in its form, originating from external practical activity, is not separated from it and does not stand above it but continues to preserve an essential, two-fold connection with it. (p. 97)

Leont'ev (2009), extending Vygotsky's approach, contends that the object-oriented activity be the unit of analysis for psychological studies. For him, human activity is not only tool-mediated, as Vygotsky asserts, but also object-oriented, which is situated in a community of practice. The unit of word meaning is too narrow to include the various aspects of an activity, and it needs to be extended to a more overarching system. Explaining Leont'ev's concept of activity, Kuutti (1991) writes:

> The solution offered by Activity Theory is that there is a need for an intermediate concept - a minimal meaningful context for individual actions - which must form the basic unit of analysis. This unit - better defined and more stable than just an arbitrarily selected context, but also more manageable than a social system – is called an activity. Because the context is included in the unit of analysis, the object of our research is always essentially collective, even if our main interest lies in individual actions. (p. 254)

Engeström's systemic model represents this object-oriented, tool-mediated, and community-based activity as the unit. However, it has been acknowledged that the activity system model does not capture the dynamic interactions between different traditions, perspectives, and cultures in a dialogical situation (Daniels, 2004; Engeström, 2001; Cole, 1988; Griffin & Cole, 1984). Although the historical and dynamic aspects of human activity are frequently emphasized in activity theorists' works, the systemic model of activity does not afford any analytical framework for dialogical interactions between different systems.

In terms of the unit of analysis, the problem may stem from its failure to apprehend the dialogical pair as the unit, not a single isolated outcome of utterance. As was discussed earlier in this section, an utterance in a conversational situation is located in the flow of dialogical chains forming dialogical pairs that are not reducible to their constituents. Without the wholeness of the responding and the responded parts of a pair taken into account, we may not comprehend an utterance situated in the dialogical context relevantly. Therefore, I argue that the minimum unit of analysis for the CMC research needs to be the dialogical pair of the responding and the responded utterances.

Emergence of collective action
The pair unit in dialogue involves at least two utterances: an initiation and a response. In the unit, two different systems of utterance production share the key elements of an activity system, become fused together, and form a collective action in which the initiator and the responder function as an agency of the system. The subjects in the pair may be regarded as a unit, because their needs, objects, tools, and communal contexts are shared in the practice of dialogue.

First, the topic as the object of activity system is shared. When two utterances become a pair when the second utterance is connected, as a response, to the first one, the initiation is transformed into a thematic exchange while

the response being a rhematic one (Gruber, 1998). During this formation of a dialogical pair, a discourse topic emerges. It is embedded in the initiation, and activated by the response. The topic is in the initiator's possession, for it derives from his or her utterance, and, at the same time, it is the responder who determines the discourse topic because the initiation will remain as an unrealized attempt to be a topical pair until it has a rejoinder. Topic is produced through the collaboration of the pair, which is the shared object of the collective action of the interlocutors.

Second, the subjects' needs are shared in the pair of dialogical exchanges. Production and publication of the second utterance entails participation in the topical space that the initiator has established. The initiator's intention or driving need is embedded in the space, and, to participate in the space, the responder should accept and be subordinated to it.

17. Henry: So, was anyone else trying to figure out how much the various pay rates in the proofreading article would work out to in current dollars?
31. Amy: i wondered if there were any guidelines about proofreading here… (From Session 13, November 19, 2009)

Henry raised the issue of the various pay rates in proofreading. Amy told, in her response, that she had also wondered about such guidelines, which indicated that she had the same, or at least similar, kind of interest as Henry did. To participate in the topical space that Henry had set up, a responder should exhibit some kind of relations with the existing illocutionary force. For instance, another member could show agreement; raise a related question; provide supplementary information; or tell a joke about the pay rates of proofreading. In any cases, the participants share the Henry's original needs to know the proofreading pay rates, and collaborate to satisfy the needs and to achieve the goal.

Third, the tools are shared. The interlocutors utilize the same SCMC technology as the communicational medium and the same language that is comprehensible for all of the participants. Furthermore, the second utterance of the pair reuses or paraphrases the words, concepts, phrases, or sentences in the first utterance to show the relation to it. In the example, Amy repeated Henry's word, "proofreading" originated from the class topic and one of the articles of the week. Even though there were no vocatives or orientational markers indicating to which message Amy's comment was directed, the participants, and the researcher as well, could notice that her message is a continuation of Henry's comment due to the use of proofreading. Having been a tool that had served Henry's purpose, the word, proofreading was employed to express Amy's similar curiosity and to exhibit the connection of her comment to Henry's. The constitution of a dialogical pair implies the exhibition of any kinds of relations between them. The whole or a part of the written texts as a symbolic means of the initiating utterance are repeated, paraphrased, revoiced, and, therefore, shared in the collective action of the pair.

Finally, the paired activity systems are situated in a shared context. They are based on the same physical environment and institutional context; by responding and being responded to, they co-participate in the current social interactions; and both of them collaborate to develop a shared topic at the cognitive and intellectual dimension. Because of that, they form a sub-community, follow the same institutional rule or rhetorical genre as typified social action (Miller, 1984; Bazerman, 1994; Swales, 1990), and partake in a role divided and expected socially.

In sum, the two activity systems in a dialogical or topical pair share the needs, the topic as an object, material tools and symbolic means, and contexts of discourse community. This may satisfy the conditions for the formation of an activity system, in which multiple subjects function as one unit. In other words, when the second utterance responds to the first one, both exchanges form a dialogical pair, the outcome of the collective action of the initiator and the responder as a subject of the system.

Ecology of activity systems
An activity system is embedded in various practices of communities that differ in kind, scope, direction, and history. To describe and understand an activity system comprehensively, it needs to be delineated as a sub-system or an agent of the whole ecology of activity systems.

As discussed so far, an activity cannot exist isolated from the relations to other systems. Within SCMD, every utterance is, directly or indirectly, connected to other utterances. Both an initiation and a response shape and are shaped by each other reciprocally in the process of dialogical activity. A student may initiate a topical thread in consideration of other members' interests, and they may respond to it intrigued by the initiation. The initiation is affected by the imagined future utterances from others, while it prompts the responder to enter into the topical

space. In the activity system of a dialogical pair, the future response is presumed before the initiation, and the past initiation is realized in the current response. The current activity system of utterance production is located in the network of dynamic interactions between different systems within the SCMD, which, as a whole, may be conceived as ecology of activity systems.

Activity systems beyond the current site of SCMD also intervened in the activity systems within it. The instructor's activity of course design dominated the SCMD. The outcome of her activity system had determined most of critical components of the SCMD such as class topics, weekly readings, communication tools, times and places, and so forth. Her design activity had initiated the SCMD, to which the class members responded with their participations. The institutional activity system of the University was the context of both the instructor's and the students' activity systems. The university defined the different divisions of labor between the instructor and the students, and the participants as members of the institution followed the rules set by the university.

The activity systems of technology designers, developers, and managers also played critical roles in the SCMD. Not only the students' discourse practice might be possible due to the activity of the technology groups, but also their activity had predetermined the patterns and the ways that the subjects participated in the activity. The instructor and the students should be subordinated to the functionalities and the affordances of the technology, in which the designers' and the developers' purposes or intentions were embedded. The users responded to the designers or the developers by following their prescriptions, and the latter achieved their goals by serving the formers' purposes.

The SCMD was also embedded in the activity systems of the academic discipline of writing research. The authors of the weekly readings were invited to the discourse activity; they spoke through the subjects' voices, and the subjects wrote using the authors' voices; and the SCMD continued the dialogical practices of the thought community. The rules how to participate in and develop the theoretical topics dominated the activity, and the agents who know more about the topic played key roles in the activity system.

An activity system in SCMD is located in a complicated and intertwined dialogical network, in which different systems emerge, interact, and disappear continuously and dynamically. Furthermore, the system itself is a dialogical response to external or broader systems of activity. These activity systems, co-present within and beyond the current activity, form the ecology of activity systems as a whole.

CONCLUSION
In this article, I have described the six elements of Engeström's activity system model in order to identify the kinds and the characteristics of the discourse activity enacted in the context of synchronous online classroom discussion. The major theme emerging from the investigation is that these elements form an irreducible whole determining each other reciprocally, which is situated in the intersection of various broader communities.

Findings from this study may yield productive implications for the future research. First, the focus of educational research on SCMD needs to move from the surface to the deep structure of the activity. Based on this report, an activity system stems from multiple dimensions of contexts, which interact together and co-determine the individual actions simultaneously. Nonetheless, the practice of CMC research does not proceed far beyond the surface level. For example, the long-lasting and still on-going discussion about the unit of analysis in CMC research is mostly about determining the starting and the ending points of data from transcripts. In general, sentences, messages, paragraphs, and threads are used as examples (De Weaver, et al., 2006). Clear rules for the identification and the distinction of units will increase, using statistical terms, the reliability of the research. However, the validity of the study remains questionable as questions such as why a unit is more valid than another has not found sound theoretical rationales as of yet. Because the observable facade of a unit is deeply situated in the system of activity, the discussion on unit of analysis should take not only the rules to identify a unit at the surface level, but also the hidden, more substantially determining, and deeply structured factors into account.

Second, the study suggests that the focus of future research on SCMD be moved from the isolated elements to the interconnected system as a whole. According to Activity Theory, an activity system forms an irreducible whole, which cannot be divided into its elements without losing its unique features (Wertsch, 1998). Subjects' driving needs should be understood in relation to the objects to which they are oriented; an object should be conceived as a true motive when being combined with subjective needs; and, in an activity system, tools have dual statuses of both an objective entity belonging to the external world and a part of the extended body of a subject. Failing to grasp the whole system and focusing only on the parts isolated from the whole may lead a researcher to more confusing or conflicting conclusions. A researcher whose purpose is to prove the

effectiveness of technology use in a classroom discussion should take into consideration its relations to the users' intentions, the characteristics of tasks, the institutional culture and rules, the divisions of labor in the community, and various kinds of intervening sub-, and meta-systems of activity as a whole. The different configurations of the related elements of a system may produce contrasting consequences for the same technology use, which may confuse the researcher or mislead the conclusions of the study.

The third implication of the study derives from the emergence of collective subject unit. Educational researchers have been interested in the phenomenon of learning as the process in which an individual is engaged and the product that remains in the individual's mind or behavior as a result of the process. The traditional interpretation of Activity Theory is consistent with this framework. When a subject employs an objective, either material or semiotic, tool to participate in an activity, the meaning of the tool as a symbolic means emerges. The objective tool use is directed toward the object, and the symbolic means emerging from it is oriented toward the subject. The objective tool is employed to change the external world, while the meaning alters the internal mind. Vygotsky's concept of internalization corresponds to the transformation of the material or social entity into a symbolic and psychological one, which is one of his main concepts related to the process of learning. Here, again, the focus is on the individual who participates in the social interaction with more knowledgeable others and becomes equipped with psychological residuals as a consequence of the social practice. However, the findings of this study suggest the possibility of a collective unit of subjects emerging from their dialogical transactions. They share a general object, material tools, repository of symbolic means, and physical, institutional, and academic contexts, and, consequently, perform as an agent of the system. They participate in the process of learning as a unit, which implies that there will be some kinds of residuals somewhere in their minds or in the community. Although this study does not provide any clear evidence or argument about collective learning in contrast to individual learning, which was not the purpose of the study and is beyond its scope, the findings intimate the emergence of a collective unit of learners. This suggests that future research answer such questions as what exactly the product of collective learning would be; where it would be located; whether it is an aggregated sum of each psychological residual or a communal residual qualitatively different from the individual learning; how we may identify them; and so forth.

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